National Aeronautics and
Space Administration

Innovative Partnerships Program

Providing leveraged technology for Mission Directorates, Programs and Projects through investments and technology partnerships with Industry, Academia, Government Agencies and National Laboratories.

Partnership Seed Fund Call for Proposals – 2007

May 11, 2007

Innovative Partnerships Program
Partnership Seed Fund
Call for Proposals

Background

The Innovative Partnerships Program (IPP) provides leveraged technology for Mission Directorates, Programs and Projects through investments and technology partnerships with industry, academia, government agencies and national laboratories. As one of NASA's Mission Support Offices, IPP supports all four Mission Directorates and has program offices at each of the ten NASA Centers.

The IPP Partnership Seed Fund has been established as a new initiative to enhance NASA's ability to meet mission technology goals by providing seed funding to address barriers and initiate cost-shared, joint-development partnerships. The IPP Seed Fund will be used to provide "bridge" funding to enable larger partnerships and development efforts to occur and will encourage, to the maximum extent possible, the leveraging of funding, resources and expertise from non-NASA partners, NASA Programs and Projects and NASA Centers.

Partnership goals include providing for an increased range of technology solutions, a broadened technology portfolio, improved cost avoidance, accelerated development and maturation of technologies, and a larger pool of qualified commercial providers.

Scope

This internal Call to NASA is soliciting proposals for cost-shared partnerships with industry, academia, research institutions, national laboratories and other government agencies for joint development of technology that is of primary interest to NASA. This Call is being distributed through the four Mission Directorates as well as through the Center IPP offices (IPPO). In order to solicit external interest, this call will be posted to the Fedgrants website. Responses to this call must be from NASA personnel and proposals submitted directly from parties external to NASA will not be accepted.

The total budget for the Seed Fund in FY07 is $9.2 M, and the IPPO at Headquarters anticipates awarding approximately 25-30 projects; therefore, each NASA Center shall submit no more than eight (8) proposals to the Headquarters IPPO in response to this Call. Proposal submission will be conducted through the IPPOs at each Center, and the Center IPPOs will have the final approval over which proposals are submitted from that Center. Proposed projects will be evaluated by the IPPO at Headquarters in coordination with representatives from each of the four Mission Directorates based on the criteria identified within this Call.

The project awards will range in value from $50K to $250K (IPP Seed Fund portion); however, proposals exceeding $250K will be allowed on an exception basis with approval from the IPPO Director or his designee. Approval shall be obtained via the Center IPPO. Actual total project value will vary based on the full amount of leveraging available from all of the participants. Projects will typically be awarded as one year in duration, but may be longer with appropriate justification. The funds for selected proposals will be transferred to the IPP offices at those Centers for award and management of the projects.

Proposals submitted in response to this Internal Call shall include provisions for three (3) primary participants for each project to be funded as follows:

1. <u>Partnership Manager (PM)</u> – The PM will be a representative from the Center IPPO and will have primary responsibility for creating the partnership development, intellectual property and business aspects of the proposal. The PM will also assume the project management responsibilities for selected projects and will be responsible for all reporting requirements established by the IPP.
2. <u>Co-Principal Investigator (Co-PI</u>) – The NASA Co-PI will be a representative from the Program or Project office at the Center or a designated PI from within the technical organizations at that Center and will be responsible, in conjunction with the External Co-PI, for developing the technical content for the proposals and performing the technology development activities under the partnership..
3. <u>External Co-PI</u> – The External Co-PI from the non-NASA Partner will be responsible, in conjunction with the NASA Co-PI, for developing the technical content for the proposals and performing the technology development activities under the partnership.

<u>Cost-Share Requirements</u>

The IPP Seed Fund seeks to fund highly leveraged partnerships where the costs, risks, benefits and outcomes are shared by all parties involved. In order to meet this goal, the following guidelines have been established for contributions by each party:

<u>Non-NASA Partner</u> – Proposed projects must include one or more non-NASA partner(s) that is willing to provide cost-sharing at a level equal to or greater than the IPP Seed Fund dollars provided to the project. However, special situations may arise in which IPP will allow a partner's contribution to be less than the IPP Seed Fund contribution. Acceptable cost-sharing from the partner includes actual dollars applied directly to the project, in-kind considerations such as workforce labor and the use of unique and dedicated facilities and testbeds. *Monetary valuation of partner in-kind facility and/or testbed access should be based solely on actual costs incurred by the partner in the performance of the proposed project, and should not reflect the partner's original capital expenditure for construction of the subject facilities and/or testbeds.*

<u>NASA Program or Project</u> – Contributions from the Program, Project and/or Center involved in performance of the partnership is also required. These NASA contributions may be in the form of direct funding toward the partnership, funded FTEs or the use of unique and dedicated facilities and testbeds in support of the partnership. *Monetary valuation of NASA in-kind facility*

and/or testbed access should be based solely on actual costs incurred by the NASA Program, Project, or Center in the performance of the proposed Seed Fund project, and should not reflect NASA's original capital expenditure for construction of the subject facilities and/or testbeds

Innovative Partnerships Program – In addition to the Seed Funding provided directly to the partnership, the IPP also contributes to the partnership by covering all costs associated with the IPP PM function using the Center's existing IPP budget in lieu of charging these costs under the project.

Innovative Partnership Program Alignment

Proposals submitted under this call must align with one or more of the following IPP strategic business practices:

- Partnerships with universities, research institutes, industry and other government agencies that advance low Technology Readiness Level (TRL) technology that is of strategic importance to future NASA missions.

- Cost-shared projects that leverage existing research activities with universities and/or education programs such as Space Grant, summer faculty, internships, etc.

- Partnerships with industry for Dual Use technology development that focus on mid-range TRLs (from 4 to 6) to address technology gaps and needs identified by the Mission Directorates, Programs and Projects.

- Partnerships that facilitate the transition of Small Business Innovation Research (SBIR) Program and Small Business Technology Transfer (STTR) Program Phase I and Phase II development contracts into Phase III activities for further development, maturation and insertion into NASA missions.

- Cost-shared projects that address barriers and remove obstacles to technology development efforts that could then lead to larger development partnerships and projects that would be of greater significance and value to the NASA.

- Partnerships that support the strategic use of NASA intellectual property such as licensing to develop a commercial product, process or capability that is determined to be of direct benefit to NASA.

- Public/private partnerships with non-traditional partners that are leaders in the areas of science, engineering and innovative technology. Partnerships extend beyond technology development but still bring additional value to NASA Program, Projects and Centers.

- Partnerships may be complex, cross-agency and broader based, and will not follow traditional procurement paths.

Mission Directorate Alignment

Proposed partnerships **must show relevance and value to NASA Mission Directorates**. The list of Technology Focus Areas provided in "Attachment A" has been developed by each of the four Mission Directorates and is provided as guidance for the identification and selection of potential projects. Proposers should contact appropriate directorate program/project personnel for a more definitive statement of needs and potential partnership opportunities. Proposals that address cross-cutting technology that supports the needs of more than one Mission Directorate are encouraged as well as proposals that include elements of collaboration between Centers.

Partnership Objectives and Outcomes

Proposals must define clear objectives and anticipated outcomes for the proposed partnerships and demonstrate how successful projects will transition to the next phase of the technology development life-cycle or funding opportunity in support of NASA missions. While projects may be eligible for submission under subsequent Seed Fund calls in FY08 and beyond, proposals submitted under this FY07 call shall be for discreet projects with tangible and relevant results expected at the completion of the proposed project. The relevance and perceived value of the proposed outcomes will be significant factors in the evaluation and selection of proposals.

Partnership Metrics

Each proposed project must have at least one (1) metric that can be used to measure the progress and successful performance of the partnership. The metric(s) will be selected at the discretion of the proposing team; however, it must be a clear and measurable indicator of how well the partnership achieved the proposed objectives and outcomes.

Where appropriate, the NASA Technology Readiness Level (TRL) provides such a measure. The TRLs, at their most basic, describe the stages of maturity in the development process from observation of basic principals through final product operation. The exit criteria for each stage is in essence documentation that principles/concepts/applications/performance have been satisfactorily demonstrated in what ever environment is required for that stage. A description of the individual levels is provided in Attachment B, along with corresponding clarifications of hardware and software stages and their exit criteria. A description of terms is also provided which includes a description of a *relevant environment* as being a subset of the operational environments that are expected to have a dominant impact on operational performance.

Partnership Mechanisms

Awards made through this Internal Call will be in the form of Cooperative Agreements, Cooperative Research and Development Agreements (CRADAs), Space Act Agreements (usually non-reimbursable) and change orders against similar existing contracts and agreements. The PM, in conjunction with NASA Contracting Officers at the individual NASA Centers, will be responsible for determining the appropriate award instrument for the selections resulting from this solicitation. Winning proposal teams at the Centers are responsible for the selection of external partners, negotiation and execution of award instrument, and management of funds.

Cooperative Agreements will be subject to the NASA Grants and Cooperative Agreement Handbook (found at http://ec.msfc.nasa.gov/hq/grcover.htm). Modifications to existing contracts are subject to the Federal Acquisition Regulations (FAR) and the NASA FAR Supplement (see http://ec.msfc.nasa.gov/hq/library/v-reg.htm). Space Act Agreements will be subject to the NASA Space Act Agreements Manual NAII 1050-1 (see http://nodis3.gsfc.nasa.gov/1050-1.html).

Proposal Selection Criteria

1. Primary Evaluation Criteria (of equal value):

    - **Relevance and Value to NASA –** Proposal's relevance and value to current and future NASA missions, alignment with IPP objectives, linkage to Mission Directorate Technology Focus Areas.

    - **Scientific/Technical Merit and Feasibility –** Overall scientific and technical merit of the proposal.

2. Other Evaluation Criteria (of equal value):

    - **Quality of Cost-Share and Leveraging of Resources –** Level and quality of the cost-share and resources contributed by the non-NASA partner and the degree to which the proposed project leverages other NASA funding.

    - **Capability and Strength of Partnership Team –** Proposed team's capabilities, related experience, expertise, special facilities and equipment and techniques which are integral to achieving the proposal objectives; and the clarity of roles, responsibilities and interrelationship between the individual team members.

    - **Budget/Schedule –** Realism of the proposed schedule and level of funding requested relative to the anticipated goals, objectives and outcomes of the partnership; and the overall return on investment for NASA.

Proposal Format and Submission

Proposals shall be limited to five (5) pages each, (not including title page, resumes, letters of intent, endorsement or reference). Proposals that exceed the number of pages may not be considered. Text shall be single-spaced, using 12 point Times New Roman font, and all pages shall be numbered in the bottom-center of the footer.

Proposals shall contain the following information:

1. Project Title:

2. PM and Co-PI(s): Center IPP office, Program/Project representative, non-NASA partner principal participants

3. Mission Directorate(s) Supported – ARMD, ESMD, SMD and SOMD

4. Scope or Abstract – Identify the need or problem that is being addressed and summarize the overall approach to be undertaken and the value and benefits to NASA.

5. Technical Approach – Identify technical approach, current state-of-the-art work related to what's being proposed, identify related prior or current work being done in this area, and expertise and capabilities of technical team (attach short resumes). Include a schedule and key milestones for proposed work.

6. Approach to Partnering – Identify the partner(s) and their proposed contributions to the project (both financially and technically), identify NASA's contributions to the project, roles and responsibilities of each party, the proposed partnership mechanism and potential commercialization opportunities.

7. Benefit to NASA – Identify alignment to IPP elements and Mission Directorate technology focus areas, identify future value to NASA (return on investment, cost savings/cost avoidance, increased safety, reduced development time, etc.), identify next steps (exit strategy) for the technology or partnership.

8. Budget – Provide a detailed full cost budget in the following format:

Funding Requested from IPP:

			Total ($K)
	FTEs	Labor Rate	________
	WYEs	Labor Rate	________
	Procurements:		________
Program/Project/Center Resources (Non-IPP):			
	FTEs	Labor Rate	________
	WYEs	Labor Rate	________
	Procurements:		________
	Facility/Testbed Access:		________
External Partner Contribution:			
	Labor:		________
	Direct Funding:		________
	Facility/Testbed Access:		________
		Total Budget =	________

9. Performance Metric(s) – Clear and measurable indicator of successful performance (e.g. advance technology from TRL 5 to TRL 6)

10. Letter of intent from an authorized official of the proposed external partner(s)

11. Concurrence signature from a cognizant NASA Program Office Representative – The concurring official must have authority to commit program/project resources in support of the proposal. If unsure of appropriate Program/Project Office Representative, contact the appropriate Field Center IPP point of contact identified below.

All proposals submitted in response to this announcement must be received by the HQ IPPO before midnight on **August 13, 2007** and shall be submitted through the IPPOs at each of the respective Centers. Proposals shall be submitted electronically to Dr. Minoo Dastoor, IPP Chief Technologist. Each proposal shall be in a single pdf file and shall use the following file nomenclature: Center_ProjectTitle.pdf. If proprietary information precludes submittal of a proposal via email, then a computer CD containing the proposal file(s) may be mailed to Dr. Dastoor at NASA Headquarters, Mail Suite: 6F-80, 300 E Street, SW, Washington, DC 20546-0001.

A listing of Headquarters and Center IPP points of contact is provided below.

IPP Points of Contact Listing

Headquarters IPP Office:

Minoo Dastoor
Phone: 202-358-4518
Email: Minoo.N.Dastoor@nasa.gov

Center IPP Offices:

Ames Research Center:
Rich Pisarski
Phone: 650-604-1754
Email: rpisarski@mail.arc.nasa.gov

Dryden Flight Research Center:
Greg Poteat
Phone: 661-276-3872
Email: Gregory.A.Poteat@nasa.gov

Glenn Research Center:
Kathy Needham
Phone: 216-433-2802
Email: Kathleen.K.Needham@nasa.gov

Goddard Space Flight Center:
Nona Cheeks
Phone: 301-286-8504
Email: Nona.K.Cheeks@nasa.gov

Jet Propulsion Laboratory:
Ken Wolfenbarger
Phone: 818-354-3821
Email: james.k.wolfenbarger@nasa.gov

Johnson Space Center:
Michele Brekke
Phone: 281-483-4614
Email: michele.a.brekke@nasa.gov

Kennedy Space Center:
Dave Makufka
Phone: 321- 867-6227
Email: David.R.Makufka@nasa.gov

Langley Research Center:
Marty Waszak
Phone: 757 864-4015
Email: m.r.waszak@nasa.gov

Marshall Space Flight Center:
James Dowdy
Phone: 256-544-7604
Email: James.F.Dowdy@nasa.gov

Stennis Space Center:
Ramona E Travis
Phone: 228.688.3832
Email: Ramona.E.Travis@nasa.gov

Reference Websites:

Aeronautics Research Mission Directorate:
www.aeronautics.nasa.gov

Exploration Systems Mission Directorate:
www.exploration.nasa.gov

Science Mission Directorate:
www.science.hq.nasa.gov

Space Operations Mission Directorate:
www.hq.nasa.gov/osf

Attachment A

Mission Directorate Technology Focus Areas

<u>Aeronautics Research Mission Directorate:</u>

Fundamental Aeronautics
<u>Subsonic: Fixed Wing</u> – Research emphasis is on developing technologies for improving performance (reduced fuel burn), reducing noise, and reducing emissions for subsonic aircraft. A major product will be fast and effective physics based multi-disciplinary analysis and design tools with quantified levels of uncertainty that enable virtual expeditions through the design space for conventional and unconventional vehicles.

<u>Subsonic: Rotary Wing</u> - Physics-based multi-disciplinary analysis and design tools and technologies that enable increased civil competitiveness of rotorcraft, including improved efficiency, productivity, and environmental acceptance.

<u>Supersonics</u> – Tools and technology for the supersonic flight regime including: highly efficient airframes and engines, light weight and durable material and structures for high temperature, sonic boom modeling, airport noise, high altitude emissions, aeroservoelasticity, entry/descent/landing in planetary atmospheres, and integrated systems for multidisciplinary design and analysis.

<u>Hypersonics</u> – Development of physics-based multi-disciplinary analysis and design optimization predictive capabilities, incorporating uncertainties. Highly Reliable Reusable Launch Systems (HRRLS) and High Mass Mars Entry Systems (HMMES) have been chosen to focus technology and methods development efforts.

Aviation Safety Program
<u>Integrated Vehicle Health Management</u> – Airframe health management; propulsion health management; environmental health management; system architectural framework; validation and predictive capability assessment
<u>Integrated Intelligent Flight Deck</u> – Tailored flexible operator-automation management; adaptive displays and interaction; decision associate technology; intelligent information management
<u>Integrated Resilient Aircraft Control</u> – Resilient flight control; resilient propulsion control; resilient airframe control; resilient vehicle mission management; safety-critical systems V&V
<u>Aircraft Aging & Durability</u> – Detection and characterization of aging related hazards; prediction of life, strength and durability of systems with degradation; Mitigation of aging related hazards

Airspace Systems
<u>Next Generation Air Transportation System (NGATS): Airspace</u> – Adaptive air/ground automation concepts & technologies; airspace modeling and simulation; systems analysis and integration; experimental and validation

NGATS: Airportal – Adaptive air/ground automation concepts & technologies; airportal modeling and simulation; system analysis and integration; experimentation and validation

Aeronautics Test Program
Test Technology Development – Aeronautics test technology for wind tunnels and aeropropulsion test facilities that improves data quality, facility productivity, facility cost, test capability, and integration with computational.

University Research - Provide experience to graduate students in the use of large aeronautics test facilities while carrying out valuable aeronautics research.

Exploration Systems Mission Directorate:**

Structures, Materials, and Mechanisms – Lightweight composite structures for vehicles and habitats, lightweight tanks for cryogenic propellants, inflatable structures for the lunar surface, multifunctional materials, and low-temperature mechanisms.
Protection – Ablative, human-rated thermal protection system materials, lightweight radiation shielding, dust and contaminant mitigation.
Propulsion and Cryogenics – Main engines and reaction control system thrusters for the Lunar Lander, and cryogenic propellant storage systems.
Thermal Control – Advanced radiators, heat pumps, sublimators, and evaporators for thermal control of vehicles, habitats, and EVA suits.
Power – Lithium-ion and lithium-sulfur batteries, regenerative fuel cells, and technologies for solar and nuclear surface power systems.
Avionics & Software - Radiation hardened and low-temperature electronics, low-power high performance processors, integrated systems health management, automated rendezvous and docking sensors, autonomous precision landing, catastrophic event flight data recorders, reliable software development tools.
Communications – Smart telemetry systems, adaptive S-Band transponders and antennas.
Environmental Control & Life Support – Atmospheric management, environmental monitoring and control, advanced air and water recovery systems, fire detection and suppression.
Crew Support & Accommodations – Technologies for advanced EVA surface suits, including life support, power, thermal control, flexible displays, and materials; crew health care systems; habitability systems.
In-Situ Resource Utilization – Regolith excavation and material handling, oxygen production from regolith, polar volatile collection and separation.
Robotics and Operations – Advanced robotic systems for lunar outpost assembly and maintenance, surface mobility systems, human-system interaction, and supportability technologies such as electronics/wiring inspection and repair.

** It is recommended that the Technology Projects should focus on the delivery of products that can be incorporated into ground-based demonstrations of systems and operational scenarios in analog environments.

Science Mission Directorate:**

New Remote Sensing Technologies – to better see, detect, and measure the Earth, the sun, the solar system, and the universe
Large, Lower Cost, Lightweight Mirrors and Space-Deployable Structures – for the next generation of large telescopes and antennas
Novel Platforms – including power and propulsion technologies, that can take instruments to new vantage points
Intelligent Distributed Systems – that enable advanced communications, efficient data processing and transfer, and autonomous operations of land- and space-based assets
Information Synthesis – to derive useful knowledge from extremely large data sets through visualization, advanced simulations, analysis, and seamlessly linked models

** It is recommended that the Technology Projects should focus on the delivery of products that can be incorporated into airborne and/or ground-based demonstrations.

Space Operations Mission Directorate:

Space Communications – Optical communications, spacecraft RF including antennas and ground based Earth stations, surface networks, access links, navigation and timing, reprogrammable communications systems, communications systems for EVAs, advanced antenna technology and transmit array concepts, communications in support of launch services; novel operational projects that have a high return-on-investment; proposed project should be aligned with the Space Communications and Navigation Architecture as being developed by the agency.
Space Transportation – Technologies to enable a safer and more reliable space transportation capability including automated collection of range data, automated tracking and identification of objects, instrumentation for space transportation system testing, integrated system health monitoring for ground support equipment, facilities, and ground/spacecraft system interfaces, and technologies that reduce the cost of ground operations including new and innovative technology solutions for assembly, test, integration and processing of spacecraft; end-to-end launch services; specifically corrosion prevention, detection, and mitigation of corrosion in spaceport facilities and ground support equipment; non-destructive evaluation / non-intrusive inspection technologies; and operationally effective propellant loading, servicing, and storage.
Space Operation – Technologies that optimize crew health and performance using innovative technologies for procedure management of crew medical officer responses to in-flight medical issues, technologies that optimize the performance of ground operations, technologies that enable innovative use of operational assets for flight testing of developmental hardware and software.

Attachment B

Technology Readiness Level (TRL) Descriptions

Technology Readiness Level - (TRL)	Definition	Hardware Description	Software Description	Exit Criteria
1	Basic principles observed and reported	Scientific knowledge generated underpinning hardware technology concepts/applications.	Scientific knowledge generated underpinning basic properties of software architecture and mathematical formulation.	Peer reviewed publication of research underlying the proposed concept/application
2	Technology concept or application formulated	Invention begins, practical application is identified but is speculative, no experimental proof or detailed analysis is available to support the conjecture.	Invention begins, practical application is identified but is speculative, no experimental proof or detailed analysis is available to support the conjecture. Underlying Algorithms are clarified and documented.	Documented description of the application/concept that addresses feasibility and benefit
3	Analytical and/or experimental critical function or characteristic proof-of-concept	Analytical studies place the technology in an appropriate context and laboratory demonstrations, modeling and simulation validate analytical prediction.	Development of limited functionality to validate critical properties and predictions using non-integrated software components	Documented analytical/experimental results validating predicitions of key parameters
4	Component or breadboard validation in laboratory	A low fidelity system/component breadboard is built and operated to demonstrate basic functionality and critical test environments and associated performance predicitions are defined relative to the final operating environment.	Key, functionally critical, software components are integrated, and functionally validated, to establish interoperability and begin architecture development. Relevant Evironments defined and performance in this environment predicted.	Documented test performance demonstrating agreement with analytical predictions. Documented definition of relevant environment.
5	Component or breadboard validation in a relevant environment	A mid-level fidelity system/component brassboard is built and operated to demonstrate overall performance in a simulated operational environment with realistic support elements that demonstrates overall performance in critical areas. Performance predictions are made for subsequent development phases.	End to End Software elements implemented and interfaced with existing systems conforming to target environment, including the target o software environment. End to End Software System, Tested in Relevant Environment, Meets Predicted Performance. Operational Environment Performance Predicted.	Documented test performance demonstrating agreement with analytical predictions. Documented definition of scaling requirements
6	System/subsystem model or prototype demonstration in a relevant environment	A high-fidelity system/component prototype that adequately addresses all critical scaling issues is built and operated in a relevant environment to demonstrate operations under critical environmental conditions.	Prototype software partially integrated with existing hardware/software sytems and demonstrated on full-scale realistic problems.	Documented test performance demonstrating agreement with analytical predictions
7	System prototype demonstration in space	A high fidelity engineering unit that adequately addresses all critical scaling issues is built and operated in a relevant environment to demonstrate performance in the actual operational environment and platform (ground, airborne or space).	Prototype software is fully integrated with operational harware/software sytems demonstrating operational feasibility.	Documented test performance demonstrating agreement with analytical predictions
8	Actual system completed and flight qualified through test and demonstration	The final product in its final configuration is successfully demonstrated through test and analysis for its intended operational environment and platform (ground, airborne or space).	The final product in its final configuration is successfully [demonstrated] through test and analysis for its intended operational environment and platform (ground, airborne or space).	Documented test performance verifying analytical predictions
9	Actual system flight proven through successful mission operations	The final product is successfully operated in an actual mission.	The final product is successfully operated in an actual mission.	Documented mission operational results